

PART-I : PHYSICS

1) Speed v of a particle moving along a straight line, when it is at a distance x from a fixed point on the line is given by $v^2 = 108 - 9x^2$ (all quantities in S.I. unit). Then

- (1) The motion is uniformly accelerated along the straight line
- (2) The magnitude of the acceleration at a distance 3 cm from the fixed point is 0.27 m/s^2 .
- (3) The motion is simple harmonic about $x = \sqrt{12} \text{ m}$.
- (4) The maximum displacement from the fixed point is 4 cm.

2) Density of substance at 0°C is 10 g/cc and at 100°C , its density is 9.7 g/cc . The coefficient of linear expansion of the substance will be-

- (1) $10^2 \text{ }^\circ\text{C}^{-1}$
- (2) 10^{-2} K^{-1}
- (3) 10^{-3} K^{-1}
- (4) $10^{-4} \text{ }^\circ\text{C}^{-1}$

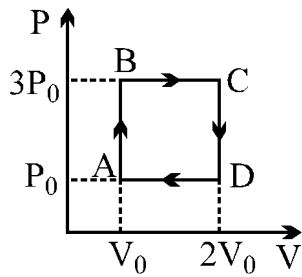
3) Assume that the entire surface of a burning log of wood is at the same temperature. Some small spots on the wood appear brighter than the rest of the surface. At such a spot-

- (1) there is a small cavity in the wood.
- (2) there is a small hump (convex portion) in the wood.
- (3) less ash has formed than on the rest of the wood.
- (4) more ash has formed than on the rest of the wood.

4) The temperature of a body falls from 52°C to 36°C in 10 minutes when placed in a surrounding of constant temperature 20°C . What will be the temperature of the body after another 10 min. (Use Newton's law of cooling)

- (1) 28°C
- (2) 20°C
- (3) 32°C
- (4) 24°C

5) An ideal monoatomic gas is carried around the cycle ABCDA as shown in the figure. The efficiency of the gas cycle is :



- (1) 4/21
- (2) 2/21
- (3) 4/31
- (4) 2/31

6) Two monoatomic ideal gas at temperature T_1 and T_2 are mixed. There is no loss of energy. If the masses of molecules of the two gases are m_1 and m_2 and number of their molecules are n_1 and n_2 respectively. The temperature of the mixture will be :

- (1) $\frac{T_1 + T_2}{n_1 + n_2}$
- (2) $\frac{T_1}{n_1} + \frac{T_2}{n_2}$
- (3) $\frac{n_2 T_1 + n_1 T_2}{n_1 + n_2}$
- (4) $\frac{n_1 T_1 + n_2 T_2}{n_1 + n_2}$

7) Two identical rooms in a house are connected by an open doorway. The temperatures in the two rooms are maintained at different values. Which room contains more air?

- (1) the room with higher temperature
- (2) the room with lower temperature
- (3) the room with higher pressure
- (4) neither, because both have the same pressure

8) A metallic wire of length L is fixed between two rigid supports. If the wire is cooled through a temperature difference ΔT (Y = young's modulus, ρ = density, α = coefficient of linear expansion) then the frequency of transverse vibration is proportional to :

- (1) $\frac{\alpha}{\sqrt{\rho Y}}$
- (2) $\sqrt{\frac{Y \alpha}{\rho}}$
- (3) $\frac{\rho}{\sqrt{Y \alpha}}$
- (4) $\sqrt{\frac{\rho \alpha}{Y}}$

9) E_n and L_n represent the total energy and the angular momentum of an electron in the n^{th} allowed orbit of a hydrogen like atom. Then

- (1) $E_n \propto L_n$
- (2) $E_n \propto L_n^2$
- (3) $E_n \propto L_n^{-1}$
- (4) $E_n \propto L_n^{-2}$

10) The binding energies of the atom of elements A & B are E_a & E_b respectively. Three atoms of the element B fuse to give one atom of element A. This fusion process is accompanied by release of energy e . Then E_a, E_b are related to each other as

- (1) $E_a + e = 3E_b$
- (2) $E_a = 3E_b$
- (3) $E_a - e = 3E_b$
- (4) $E_a + 3E_b + e = 0$

11) A heavy nucleus having mass number 200 gets disintegrated into two small fragments of mass numbers 80 and 120. If binding energy per nucleon for parent atom is 6.5 MeV and for daughter nuclei is 7 MeV and 8 MeV, respectively, then the energy released in the decay will be :-

- (1) 200 MeV
- (2) -220 MeV
- (3) 220 MeV
- (4) 180 MeV

12) A spherical object is of diameter d and density ρ . The diameter is such that it equals De-Broglie wavelengths of the object when the object falls through vacuum, in the gravitational field of the earth, through a distance d . Then d is equal to :-

- (1) $d = \left(\frac{9h^2}{\pi^2 \rho^2 g} \right)^{1/9}$
- (2) $d = \left(\frac{18h^2}{\pi^2 \rho^2 g} \right)^{1/6}$
- (3) $d = \left(\frac{6h^2}{\pi^2 \rho^2 g} \right)^{1/9}$
- (4) $d = \left(\frac{18h^2}{\pi^2 \rho^2 g} \right)^{1/9}$

13) A parallel beam of photons of intensity I strike a plane surface at angle 45° to the surface. If plane surface have reflection coefficient 0.5 then pressure exerted by the beam on the surface (C is speed of light) is :

- (1) $\frac{3I}{4C}$
 (2) $\frac{3I}{2C}$
 (3) $\frac{I}{2\sqrt{2}C}$
 (4) $\frac{3I}{2\sqrt{2}C}$

14) The strength of magnetic field required to bend photoelectrons of maximum energy in a circle of radius 50 cm when light of wavelength

3300 Å is incident on a barium emitter is 6.7×10^{-6} T. The value of charge on the photoelectrons is obtained from this data is :-

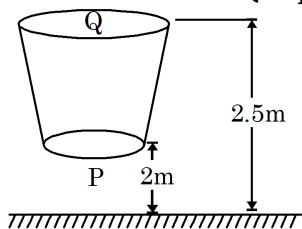
(Given : Work function of barium = 2.5 eV; mass of the electron = 9×10^{-31} kg)

- (1) 0.6×10^{-10} C
 (2) 1.8×10^{-19} C
 (3) 0.6×10^{-12} C
 (4) 1.8×10^{-20} C

15) According to Moseley's law the ratio of the slopes of graph between $\sqrt{f}$ and Z for K_β and K_α is: (where the symbols have their usual meaning).

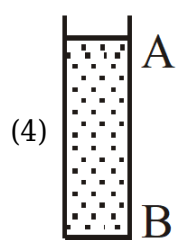
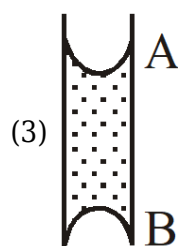
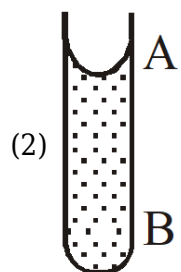
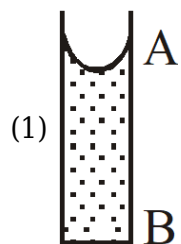
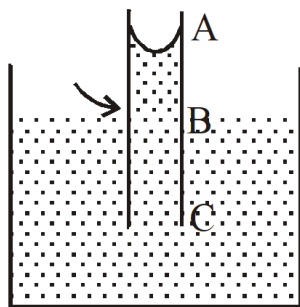
- (1) $\sqrt{\frac{32}{27}}$
 (2) $\sqrt{\frac{27}{32}}$
 (3) $\sqrt{\frac{33}{22}}$
 (4) $\sqrt{\frac{22}{33}}$

16) A non viscous liquid of constant density 10^3 kg/m³ flows in stream line motion along a vertical tube PQ of variable cross-section. Height of P and Q are 2m and 2.5m respectively. Area of tube at Q is equal to 3 times the area of tube at 'P'. Then work done per unit volume by pressure as liquid flows from P and Q. Speed of liquid at 'P' is 3 m/s.

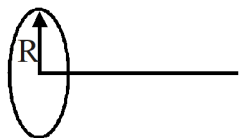


- (1) 2000 J/m³
 (2) 1000 J/m³
 (3) 1500 J/m³
 (4) 9000 J/m³

17) A glass capillary tube open at both ends is dipped in water, we can see that the water first rises in the tube and finally remains at rest at certain height as shown in figure. If this capillary tube is cut from B then the diagram of part AB is :- (B is the point where water level intersects the tube)



18) Constant current I is flowing through a circular coil of radius R . At what distance from the centre will the magnetic field (on the axis) be maximum :

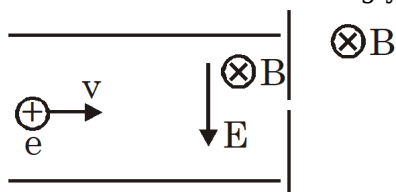


(1) $\frac{R}{\sqrt{2}}$

(2) $\frac{R}{2}$

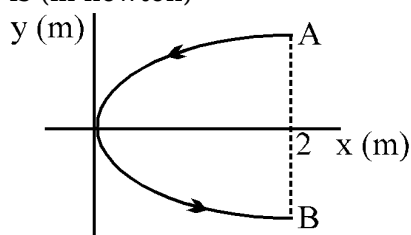
- (3) R
(4) zero

19) Consider the mass-spectrometer as shown in figure. The electric field between plates is $\vec{E}V/m$, and the magnetic field in both the velocity selector and in the deflection chamber has magnitude B. Find the radius 'r' for a singly charged ion of mass 'm' in the deflection chamber :-



- (1) $\frac{mE}{eB}$
(2) $\frac{mE^2}{eB}$
(3) $\frac{mE}{eB^2}$
(4) $\frac{mE}{Be^2}$

20) A conducting wire bent in the form of a parabola $y^2 = 2x$ carries a current $i = 2A$ as shown in figure. This wire is placed in a uniform magnetic field $\vec{B} = -4\hat{k}$ Tesla. The magnetic force on the wire is (in newton)



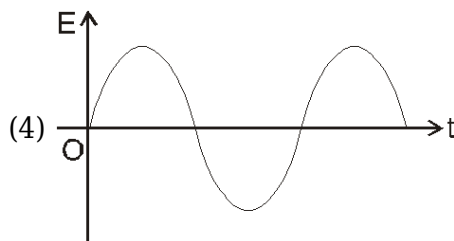
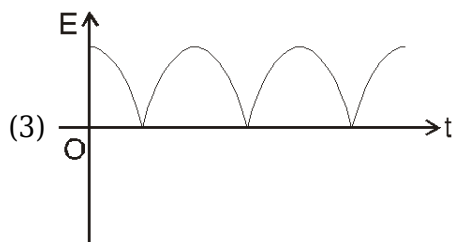
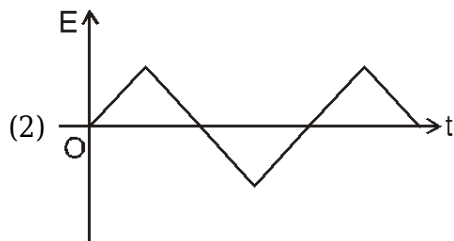
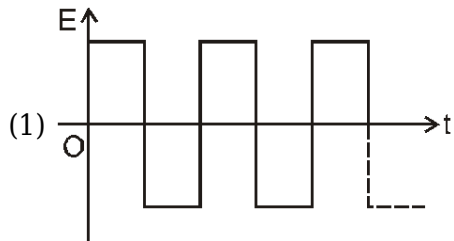
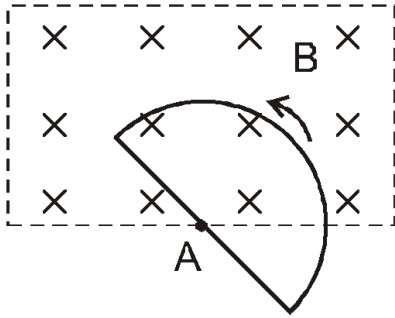
- (1) $-16\hat{i}$
(2) $32\hat{i}$
(3) $-32\hat{i}$
(4) $16\hat{i}$

21) For a paramagnetic material, the dependence of the magnetic susceptibility χ_m on the absolute temperature T is given by :

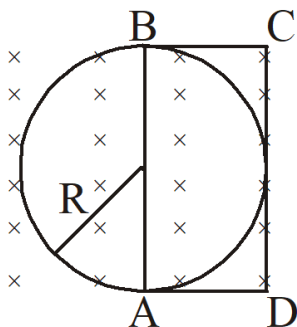
- (1) $\chi_m \propto T$
(2) $\chi_m \propto \exp(\text{constant} \times T)$
(3) $\chi_m \propto (1/T)$
(4) $\chi_m = \text{constant}$

22) A uniform and constant magnetic field B is directed perpendicularly into the plane of the page everywhere within a rectangular region as shown in figure. A wire circuit in the shape of a semicircle is uniformly (that is with uniform angular speed) rotated counter clockwise in the plane of the page about an axis A. The axis A is perpendicular to the page at the edge of the field and

directed through the centre of the straight line portion of the circuit. Which of the following graphs best approximates the emf E induced in the circuit as a function of time t ?



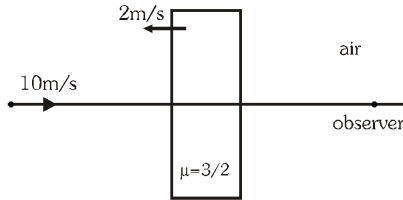
23) There exists a uniform but time varying magnetic field $B = a + bt$ normal to plane of paper in a cylindrical region as shown. A rectangular conducting loop is placed as shown. Induced emf in branches AB and BC are



(1) $\pi R^2 b/2, 0$

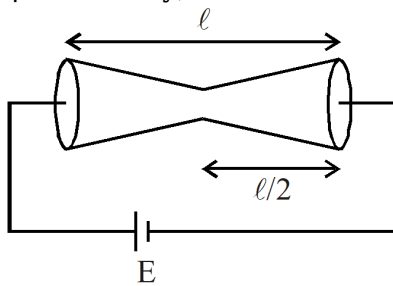
- (2) $2R^2b, 0$
 (3) $0, \pi R^2b/8$
 (4) $0, R^2b/2$

24) In the figure a slab of refractive index $3/2$ is moved towards an object which is also moving with velocity 10 m/s as shown in the figure. The velocity of image seen by the observer will be



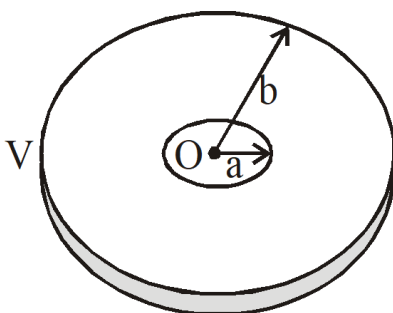
- (1) 12 m/s
 (2) 8 m/s
 (3) 10 m/s
 (4) 18 m/s

25) Maximum and minimum radii of given cylindrical conductor PQ are r_1 and r_2 then current through the battery will be (ρ - resistivity)



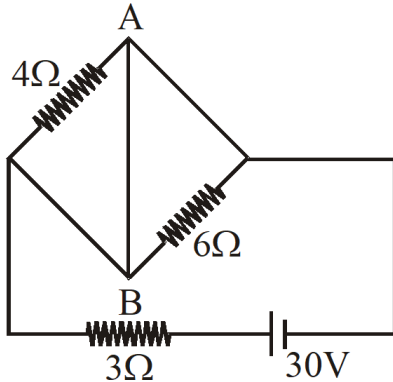
- (1) $\frac{\pi E r_1 r_2}{\rho \ell}$
 (2) $\frac{2\pi E r_1 r_2}{\rho \ell}$
 (3) $\frac{\pi E r_1 r_2}{2\rho \ell}$
 (4) None

26) A circular portion is cut of a disc of thickness t , its resistivity is r and radii of disc are a and b ($b > a$). A potential difference is maintained between outer and inner cylindrical surfaces of the disc. What is resistance of the disc ?



- (1) $\frac{\rho}{2\pi t} \ln\left(\frac{b}{a}\right)$
- (2) $\rho\left(\frac{1}{a} - \frac{1}{b}\right)$
- (3) $2\pi\rho t\left(\frac{1}{a^2} - \frac{1}{b^2}\right)$
- (4) $\frac{\rho}{2\pi t}\left(\frac{b^2 - a^2}{ab}\right)$

27) In the circuit shown in figure :-



- (1) Power supplied by the battery is 300 W
- (2) Current flowing in the circuit is 5 A
- (3) Potential difference across 4Ω resistance is not equal to the potential difference across 6 resistance
- (4) Current in wire AB is zero

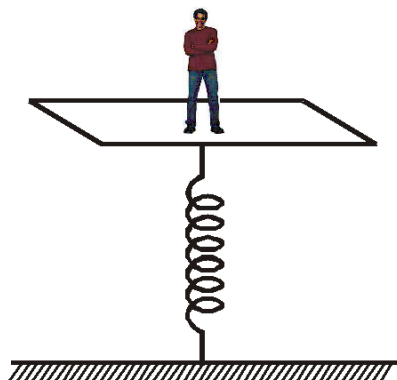
28) Power transfer by a non-ideal cell to an external resistor can be same for two different values. Out of which one value (R_1) is less than internal resistance of cell and another (R_2) is greater than internal resistance of cell then :

- (1) R_1 will give less internal loss
- (2) R_1 will give more battery life
- (3) R_2 will give less efficiency
- (4) R_2 will give more battery life

29) A particle of mass m executes SHM according to the equation $\frac{d^2x}{dt^2} + kx = 0$. Its time period will be:

- (1) $\frac{2\pi}{\sqrt{k}}$
- (2) $2\pi\sqrt{\frac{m}{k}}$
- (3) $2\pi k$
- (4) $2\pi\sqrt{k}$

30) A man weighing 60 kg stands on the horizontal platform of spring balance. The platform starts executing simple harmonic motion of amplitude 0.1 m and frequency $\frac{2}{\pi}$ Hz. Which of the following statement, is most correct :-



- (1) The spring balance reads the weight of man as 60 kg
- (2) The spring balance reading fluctuates between 60 kg and 70 kg
- (3) The spring balance reading fluctuates between 50 kg and 60 kg
- (4) The spring balance reading fluctuates between 50 kg and 70 kg

PART-II : CHEMISTRY

1) If Aufbau's rule is not followed and electron filling is done shell after shell, then number of unpaired electrons present in copper will be

- (1) 0
- (2) 1
- (3) 2
- (4) 3

2) Which of the following statement is incorrect ?

- (1) $\Delta H_{e.g}$ value of noble gases are negative
- (2) Si is diagonally related to B.
- (3) The element which have higher negative $\Delta H_{e.g}$ act as strong oxidising agent
- (4) H^+ and Cs^+ are the smallest and largest cation in periodic table respectively

3) (I) $PH_4I + KOH \rightarrow$

(II) $4H_3PO_3 \xrightarrow{\Delta}$

(III) $2H_3PO_2 \xrightarrow{\Delta}$

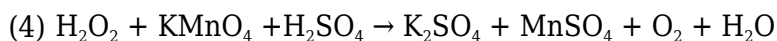
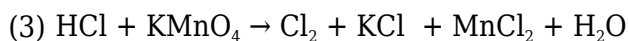
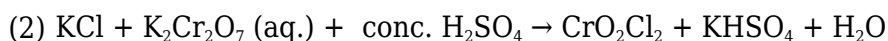
(IV) $P_4 + 3NaOH + 3H_2O \rightarrow$

Which of the following product is common in above four reaction.

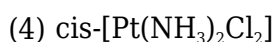
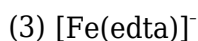
- (1) PH_3
- (2) H_3PO_4
- (3) P_4O_6

(4) P_2O_5

4) Pick the incorrect match for given reactants and products (ignore balancing) :



5) Which of the following complex shows optical activity ?



6) Select the correct statement ?

(1) Stability of $Cu^{+2}_{(aq)}$ is greater than $Cu^{+1}_{(aq)}$ due to much more negative $\Delta H^\ominus_{\text{hydration}}$ of Cu^{+2}

(2) $Cu^{+2}_{(aq)}$ is more stable because IE_2 of Cu is less than IE_1

(3) Generally salts Cu^{+2} are diamagnetic & colour less

(4) SRP ($E^\ominus$) of Cu^{+2}/Cu is negative

7) Which of the following is incorrect for f-block elements

(1) For lanthanoids +3 is the most common oxidation state.

(2) Lanthanoids have less tendency towards complex formation

(3) Basic character of oxides of lanthanoids decreases on increasing atomic number.

(4) Neptunium does not exhibit +7 oxidation state.

8) Which of the following methods are used for removal of temporary hardness only :-

(1) Boiling

(2) Clark's

(3) Zeolite

(4) Both (1) and (2)

9) Deficiency of vitamin E causes

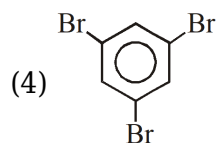
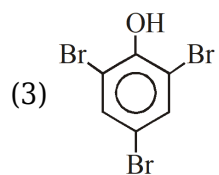
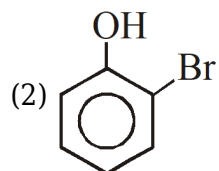
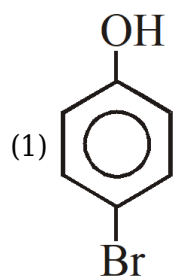
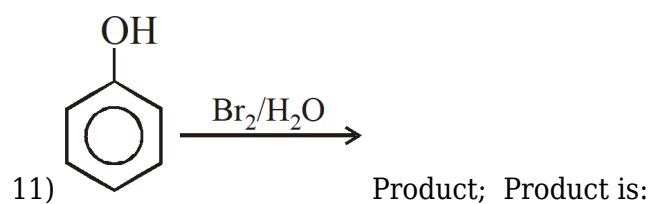
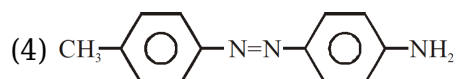
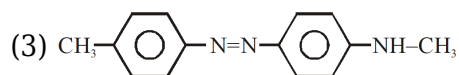
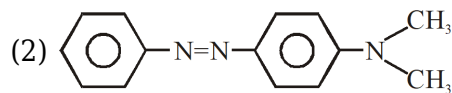
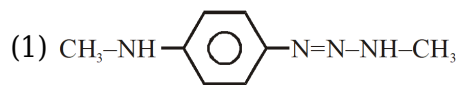
(1) Scurvy

(2) Loss of appetite

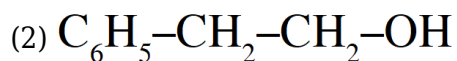
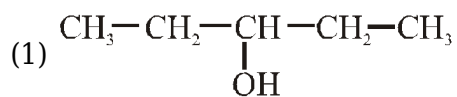
(3) Loss of sexual power

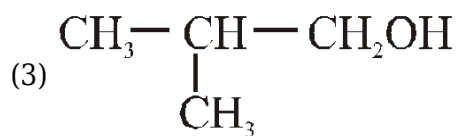
(4) Beri beri

10) Aniline $\xrightarrow[0-5^{\circ}\text{C}]{\text{NaNO}_2 + \text{HCl}}$ X $\xrightarrow{\text{N,N-Dimethylaniline}}$ Y
 (a coloured product)
 The structure of Y would be :



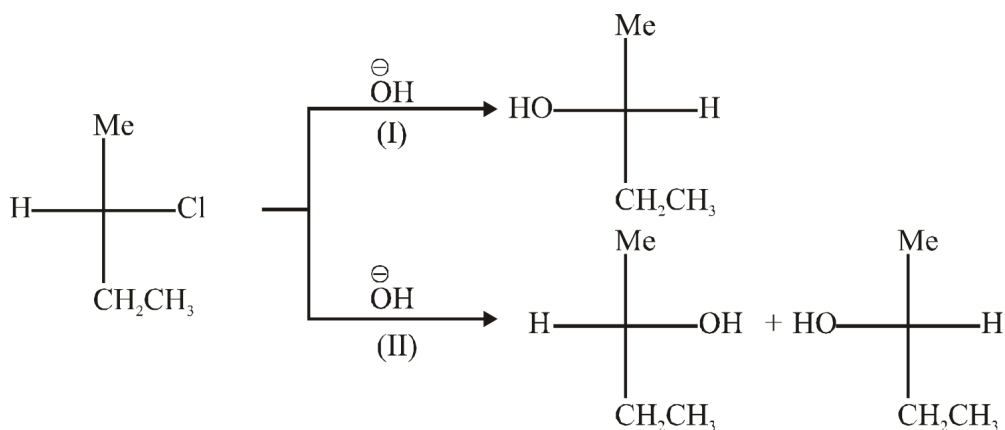
12) Among the following the one that gives positive iodoform test upon reaction with I_2 and NaOH is:-





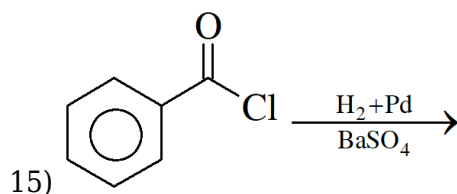
13) Which of the following represent electrophile:

- (1) NaOH
- (2) CH_3MgX
- (3) BF_3
- (4) NH_3



14) Reaction Ist and IInd are:

- (1) Both $\text{S}_{\text{N}}1$
- (2) Both $\text{S}_{\text{N}}2$
- (3) (I) $\text{S}_{\text{N}}1$, (II) $\text{S}_{\text{N}}2$
- (4) (I) $\text{S}_{\text{N}}2$, (II) $\text{S}_{\text{N}}1$



The above reaction is known as

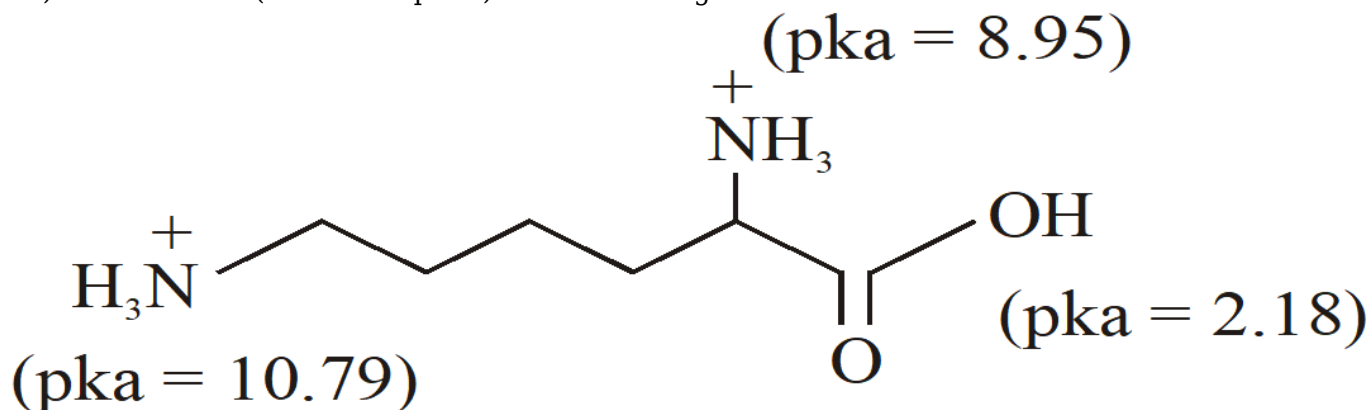
- (1) Etard reaction
- (2) Rosenmund's reduction
- (3) Friedel craft reaction
- (4) Clemmensen's reduction

16) Natural rubber is also called as

- (1) cis-1, 4-polyisoprene
- (2) trans-1, 4-polyisoprene

- (3) cis-1, 4-neoprene
- (4) trans-1, 4-neoprene

17) What is the P^I (Isoelectric point) of the following amino acids ?

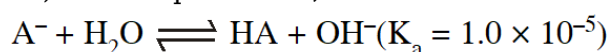


- (1) 3.22
- (2) 5.6
- (3) 6.49
- (4) 9.87

18) 200 units of energy is required to take away electron from the lowest energy level to infinity. The energy released when electron falls from infinite level to the second shell (Assuming Bohr model to be applicable) will be -

- (1) 100 units
- (2) 400 units
- (3) 50 units
- (4) 25 units

19) In the equilibrium ;



The degree of hydrolysis of 0.001 M solution of the salt is

- (1) 10^{-5}
- (2) 10^{-4}
- (3) 10^{-3}
- (4) 10^{-6}

20) The increasing order of effusion among the gases, H_2 , O_2 , NH_3 and CO_2 is -

- (1) H_2 , CO_2 , NH_3 , O_2
- (2) H_2 , NH_3 , O_2 , CO_2
- (3) H_2 , O_2 , NH_3 , CO_2
- (4) CO_2 , O_2 , NH_3 , H_2

21) Which of the following has been arranged in order of decreasing freezing point ?

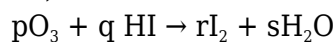
- (1) $0.05 \text{ M KNO}_3 > 0.04 \text{ M CaCl}_2 > 0.140 \text{ M sugar} > 0.075 \text{ M CuSO}_4$
 (2) $0.04 \text{ M BaCl}_2 > 0.140 \text{ M sucrose} > 0.075 \text{ M CuSO}_4 > 0.05 \text{ M KNO}_3$
 (3) $0.075 \text{ M CuSO}_4 > 0.140 \text{ M sucrose} > 0.40 \text{ M BaCl}_2 > 0.05 \text{ M KNO}_3$
 (4) $0.075 \text{ M CuSO}_4 > 0.05 \text{ M NaNO}_3 > 0.140 \text{ M sucrose} > 0.04 \text{ M BaCl}_2$

22) According to Freundlich adsorption isotherm, which of the following is correct ?

- (1) $\frac{x}{m} \propto p^0$
 (2) $\frac{x}{m} \propto p^1$
 (3) $\frac{x}{m} \propto p^{1/n}$

(4) All the above are correct for different ranges of pressure

23) What are the value of p, q, r and s for the following reaction

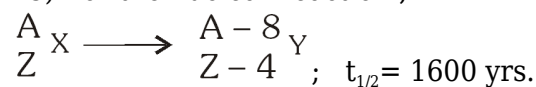


- (1) 1, 6, 3, 1
 (2) 1, 6, 3, 3
 (3) 1, 6, 6, 3
 (4) 1, 6, 3, 6

24) Number of lines when an electron return from 5th orbit to ground state in H-spectrum

- (1) 5
 (2) 4
 (3) 3
 (4) 10

25) For the nuclear reaction ;



If initial activity was 10^7 dps, how many α -particles will be emitted per second after 4800 years ?

- (1) $1.25 \times 10^6 \text{ s}^{-1}$
 (2) $2.5 \times 10^6 \text{ s}^{-1}$
 (3) $1.25 \times 10^7 \text{ s}^{-1}$
 (4) None

26) The presence of colloidal particles can be confirmed with the help of

- (1) naked eye
 (2) ordinary microscope
 (3) ultra-microscope
 (4) None of these

27) Calculate the value of Avagadro number from the following data :

Density of NaCl = 2.165 g cm^{-3} , distance between Na^+ and Cl^- ions in NaCl crystal = 281 pm.

- (1) 1.52×10^{23}
- (2) 3.04×10^{23}
- (3) 6.09×10^{23}
- (4) 12.18×10^{23}

28) 4 moles of HI is taken in a 1 litre closed vessel and heated till equilibrium is reached. At equilibrium, the concentration of H_2 is 1 mol lit^{-1} . What is the equilibrium constant for $2\text{HI} \rightarrow \text{H}_2 + \text{I}_2$.

- (1) 4
- (2) 0.5
- (3) 2
- (4) 0.25

29) When 1.0gm equivalent of each acid HA and HB are neutralized separately by NaOH the amount of heat released are 43kJ and 27kJ respectively. Which of the following is incorrect

- (1) Both HA and HB are weak acids
- (2) Ionisation constant of HA is greater than HB
- (3) Enthalpy of ionisation of HB is greater than HA
- (4) Enthalpy of ionisation of HA is greater than HB

30) Which of the following is not an anodic reaction-

- (1) $\text{Ag}^+_{(\text{aq})} \rightarrow \text{Ag}_{(\text{s})} - \text{e}^-$
- (2) $\text{Cu}_{(\text{s})} \rightarrow \text{Cu}^{2+}_{(\text{aq})} + 2\text{e}^-$
- (3) $\text{Fe}^{2+}_{(\text{aq})} \rightarrow \text{Fe}^{3+}_{(\text{aq})} + \text{e}^-$
- (4) $4\text{OH}^-_{(\text{aq})} \rightarrow 2\text{H}_2\text{O}_{(\text{l})} + \text{O}_{2(\text{g})} + 4\text{e}^-$

PART-III : MATHEMATICS

1) The values of x, for which the 6th term in the expansion of

$$\left\{ 5^{\frac{1}{3} \log_5(4^x+5)} + \frac{1}{5^{\frac{1}{5} \log_5(2^x+1)}} \right\}^8 \text{ is } 168, \text{ is equal to-}$$

- (1) 1, 3
- (2) 1, 2
- (3) 0, 1
- (4) 0, 2

2) X-component of $\vec{a}$ is twice its Y-component. If the magnitude of the vector is $5\sqrt{2}$ and it makes an angle of 135° with z-axis then the vector is :

- (1) $2\sqrt{3}, \sqrt{3}, -3$
- (2) $2\sqrt{6}, \sqrt{6}, -6$
- (3) $2\sqrt{5}, \sqrt{5}, -5$
- (4) None of these

3) If the circle $x^2 + y^2 + 2gx + 2fy + c = 0$ bisects the circumference of the circle $x^2 + y^2 - 2x - 4y - 11 = 0$, then the area of equilateral triangle taking common chord as side of the triangle will be :-

- (1) $16\sqrt{3}$ sq.units
- (2) $4\sqrt{3}$ sq.units
- (3) $8\sqrt{3}$ sq.units
- (4) 8 sq. units

4) If $\sin x + \operatorname{cosec} x = 2$, where x is acute angle then the value of $\sin^3 x + \operatorname{cosec}^3 x$ is equal to-

- (1) 4
- (2) 1
- (3) 2
- (4) 8

5) If a, b, c are in A.P., then for the equation $3ax^2 - 4bx + c = 0$:

- (1) Both roots are negative
- (2) Both roots are of opposite sign
- (3) Both roots lies in $(0, 1)$
- (4) At least one root lies in $(0, 1)$

6) If $a_1, a_2, a_3, \dots$ are in A.P. such that, $a_1 + a_5 + a_{10} + a_{15} + a_{20} + a_{24} = 225$, then $a_1 + a_2 + a_3 + \dots + a_{23} + a_{24}$ is equal to :

- (1) 909
- (2) 75
- (3) 750
- (4) 900

7) If the length of subnormal is equal to the length of subtangent at any point on the curve $y = f(x)$ and the tangent at $(3, 4)$ to $y = f(x)$ meets the positive coordinate axes at A and B, then area of $\triangle OAB$, where O is origin, is -

- (1) $\frac{25}{2}$
- (2) $\frac{9}{2}$
- (3) $\frac{1}{2}$

(4) $\frac{49}{2}$

8) If one root of equation $Ax^2 + Bx + C = 0$, where $A, B, C \in \mathbb{R}$ is $2i$ then value of $B^3(A^3 - C^3) -$

(1) $\frac{1}{8}$

(2) -8

(3) 0

(4) 4

9) The length of the normal at 't' on the curve $x = a(t + \sin t)$, $y = a(1 - \cos t)$ is :-

(1) $\tan \frac{t}{2}$

(2) $2a \sin \frac{t}{2} \cos \frac{t}{2}$

(3) $2a \sin^2 \frac{t}{2} \sec \frac{t}{2}$

(4) $a \sin t$

10) If $f(x) = x + c$, then $f(1), f(2), f(3), \dots, f(n)$ is an A.P., then $\sum_{x=1}^n f(x)$ and common difference are:

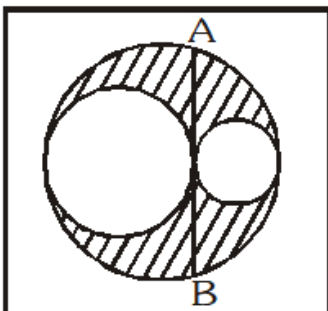
(1) $\frac{n(n+2c+1)}{2}, 1$

(2) $\frac{n(n+c)}{2}, \frac{1}{2}$

(3) $\frac{n(n+2c)}{2}, -\frac{1}{2}$

(4) None of these

11) If the length of chord AB is 4 (as shown in adjacent figure), then find the area of shaded region -



(1) $\frac{\pi}{2}$

(2) π

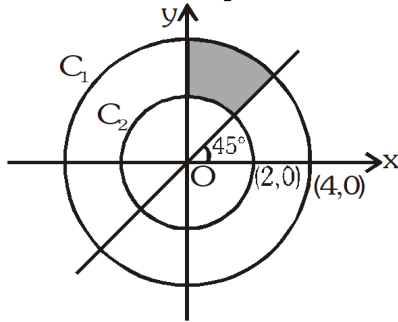
(3) $\pi + 1$

(4) 2π

12) If each pair of the equation $x^2 + ax + b = 0$, $x^2 + bx + c = 0$ and $x^2 + cx + a = 0$ has a different common root, then product of all common roots can be -

- (1) $\sqrt{abc}$
- (2) $2\sqrt{abc}$
- (3) $\sqrt{ab + bc + ca}$
- (4) $2\sqrt{ab + bc + ca}$

13) As shown in figure C_1 & C_2 are two concentric circles with centres at origin and respective radii are 4, 2 units. If point $(a, 3)$ lies inside the shaded region, then interval of a will be-



- (1) $a > 0$
- (2) $-\sqrt{7} < a < \sqrt{7}$
- (3) $a < 3$
- (4) $0 < a < \sqrt{7}$

14) Number of rational roots of the equation $x^3 - 3x + 1 = 0$

- (1) 0
- (2) 1
- (3) 2
- (4) 3

15) If z & w satisfy $z + \frac{1}{z} = w + \frac{1}{w}$ as well as $z + \frac{1}{w} = w + \frac{1}{z}$, then $|z^2 - w^2|$ is equal to -

- (1) 1
- (2) $\sqrt{2}$
- (3) 0
- (4) None of these

16) Cards are drawn one by one without replacement at random from a well shuffled pack of 52 cards until 2 clubs are obtained for the first time, for this 5 draws are required. The probability that 6th card is an Ace of heart is -

- (1) $\frac{13}{188} \cdot \frac{{}^{39}C_3}{{}^{52}C_4}$
- (2) $\frac{13}{188} \cdot \frac{{}^{38}C_3}{{}^{52}C_4}$

$$(3) \frac{{}^{13}C_2 \cdot {}^{39}C_3}{{}^{52}C_5 \cdot {}^{47}C_1}$$

$$(4) \frac{{}^{13}C_2 \cdot {}^{38}C_3}{{}^{52}C_5 \cdot {}^{47}C_1}$$

17) There is only one way to choose real numbers M and N such that when the polynomial $5x^4 + 4x^3 + 3x^2 + Mx + N$ is divided by the polynomial $x^2 + 1$, the remainder is 0. If M and N assume these unique values, then M - N is-

$$(1) -6$$

$$(2) -2$$

$$(3) 6$$

$$(4) 2$$

18) If in a group of five married couples each male shakes hand with exactly one female similarly each female shakes hand with exactly one male, then the probability that no husband shake hands with his own wife, is -

$$(1) \frac{23}{24}$$

$$(2) \frac{11}{25}$$

$$(3) \frac{119}{120}$$

$$(4) \frac{11}{30}$$

$$A \equiv \left(-\frac{\pi}{2}, \frac{\pi}{2}\right) \text{ and } f(x) = \begin{cases} \frac{x \ln \cos x}{\ln(1+x^2)} & x \neq 0 \\ 0 & x = 0 \end{cases} . \text{ The set of}$$

19) Let $f: A \rightarrow B$ be a function such that points where $f(x)$ is differentiable is -

$$(1) A - \{0\}$$

$$(2) A$$

$$(3) A - \{1, 0\}$$

$$(4) A - \{-1, 1, 0\}$$

20) The point A(8, 2), B(5, -3) and C(0, 0) are vertices of -

(1) An equilateral triangle

(2) A right angled triangle

(3) An isosceles right angled triangle

(4) An isosceles triangle

$$21) f(x) = \frac{2 \cos x - \sin 2x}{(\pi - 2x)^2}; g(x) = \frac{e^{-\cos x} - 1}{8x - 4\pi}$$

$$h(x) = f(x) \text{ for } x < \pi/2$$

$$= g(x) \text{ for } x > \pi/2$$

then which of the following holds ?

- (1) h is continuous at $x = \pi/2$
- (2) h has an irremovable discontinuity at $x = \pi/2$
- (3) h has a removable discontinuity at $x = \pi/2$
- (4) $f\left(\frac{\pi^+}{2}\right) = g\left(\frac{\pi^-}{2}\right)$

22) The points $(\lambda + 1, 1)$, $(2\lambda + 1, 3)$ and $(2\lambda + 2, 2\lambda)$ are collinear, if :-

- (1) $\lambda = -1, 2$
- (2) $\lambda = \frac{1}{2}, 2$
- (3) $\lambda = 2, 1$
- (4) $\lambda = -\frac{1}{2}, 2$

23) If $I_1 = \int_a^b \frac{e^{x/a}}{x} dx$ and $I_2 = \int_a^b \frac{e^{b/x}}{x} dx$, then :-

- (1) $I_1 > I_2$
- (2) $I_1 < I_2$
- (3) $I_1 = I_2$
- (4) $aI_1 = bI_2$

24) A committee of 5 is to be chosen from group of 9 people. Number of ways in which it can be formed if 2 particular persons either serve together or not at all and 2 other particular persons refuse to serve with each other is -

- (1) 41
- (2) 36
- (3) 47
- (4) 76

25) If the value of the integral $\int_1^2 e^{x^2} dx$ is α , then the value of $\int_e^{e^4} \sqrt{\ln x} dx$ is :

- (1) $e^4 - e - \alpha$
- (2) $2e^4 - e - \alpha$
- (3) $2(e^4 - e) - \alpha$
- (4) None

26) A tea party is arranged for 16 people along two sides of a large table with 8 chairs on each side.

Four men want to sit on one particular side and two on the other side. The number of ways in which they can be seated is

- (1) $\frac{6!8!10!}{4!6!}$
- (2) $\frac{8!8!10!}{4!6!}$
- (3) $\frac{8!8!6!}{6!4!}$
- (4) none of these

27) Let m be a positive integer &

$$D_r = \begin{vmatrix} 2r-1 & {}^m C_r & 1 \\ m^2-1 & 2^m & m+1 \\ \sin^2(m^2) & \sin^2(m) & \sin^2(m+1) \end{vmatrix} \quad (0 \leq r \leq m), \text{ then the value of } \sum_{r=0}^m D_r \text{ is given by :}$$

- (1) 0
- (2) $m^2 - 1$
- (3) 2^m
- (4) $2^m \sin^2(2^m)$

28) If A is a matrix of order 3×4 , then both AB^T and $B^T A$ are defined if order of B is

- (1) 3×3
- (2) 4×4
- (3) 4×3
- (4) 3×4

29) The absolute value of the determinant $\begin{vmatrix} -1 & 2 & 1 \\ 3+2\sqrt{2} & 2+2\sqrt{2} & 1 \\ 3-2\sqrt{2} & 2-2\sqrt{2} & 1 \end{vmatrix}$ is :

- (1) $16\sqrt{2}$
- (2) $8\sqrt{2}$
- (3) 8
- (4) None

30) If $x = e^{y+e^{y+\dots\text{to } \infty}}$, $x > 0$ then $\frac{dy}{dx}$ is -

- (1) $\frac{x}{1+x}$
- (2) $\frac{1+x}{x}$

(3) $\frac{1-x}{x}$

(4) $\frac{1}{x}$

31) If $f(x) = \lim_{n \rightarrow \infty} (1+x)(1+x^2)(1+x^{2^2})(1+x^{2^3})\dots(1+x^{2^n})$ where $|x| < 1$, then -

(1) $\frac{1}{1-x}$

(2) $\frac{1}{1+x}$

(3) $\frac{1}{1-x^2}$

(4) $\frac{1}{1+x^2}$

32) Let $y = \sqrt{x + \sqrt{x + \sqrt{x + \dots \infty}}}$ then $\frac{dy}{dx}$ is not equal to -

(1) $\frac{1}{2y-1}$

(2) $\frac{x}{x-2y}$

(3) $\frac{1}{\sqrt{1+4x}}$

(4) $\frac{y}{2x+y}$

33) If $\int_0^{\infty} e^{-x^2} dx = \alpha$, then the value of $\int_0^{\infty} \frac{e^{-1/x^5}}{x^3 \sqrt{x}} dx$ is -

(1) α^2

(2) $\frac{7\alpha}{2}$

(3) $\frac{5\alpha}{2}$

(4) $\frac{2\alpha}{5}$

34) If $\tan^{-1}x + \tan^{-1}y + \tan^{-1}z = \pi$ then the value of $x + y + z - xyz$ is -

(1) 0

(2) 1

(3) -1

(4) 2

35) $\operatorname{cosec}^{-1}(\cos x)$ is real if -

(1) $x \in [-1, 1]$

(2) $x \in \mathbb{R}$

(3) x is an odd multiple of $\frac{\pi}{2}$

(4) x is a multiple of π

36) If $|\tan^{-1}x| + |\cot^{-1}x| = \frac{\pi}{2}$, then x belongs to :-

(1) $[0, \infty)$

(2) $(-\infty, 0)$

(3) $(-\infty, \infty)$

(4) none of these

37) Let $f(x) = \begin{cases} x & x \in I \\ x-1 & x \notin I \end{cases}, g(x) = \begin{cases} x-1 & x \in I \\ x & x \notin I \end{cases}$ then $(f+g)^{-1}(0)$ is-

(A) -1 (B) 0 (C) 2 (D)

(1) -1

(2) 0

(3) 2

(4) $\frac{1}{2}$

38) $\int \ln x^x dx + \frac{1}{2} \int x dx$ is equal to -

(1) $x^3 \ln x + c$

(2) $x^2 \ln x + c$

(3) $\frac{x^2 \ln x}{2} + c$

(4) $x \ln x + c$

39) $\int \left(2x + \frac{1}{x}\right) \sin \frac{1}{x} dx$ is equal to :-

(1) $x^2 \sin \frac{1}{x} + x \cos \frac{1}{x} + c$

(2) $x \cos \frac{1}{x} + c$

(3) $x^2 \cos \frac{1}{x} + c$

(4) none of these

40) The maximum value of coefficient of xy^2z^3 in the expansion of $(x \operatorname{cosec} \theta + y \cos \theta + z \sin \theta)^6$, where $\theta \neq n\pi, n \in \mathbb{I}$, is-

- (1) 15
- (2) 30
- (3) 45
- (4) 60

PART-IV(A) : English Proficiency

1) **DIRECTIONS** : Choose the pair of words which are related to each other same as the capitalized words given below:

THRIFTY: __::HUNGRY:GLUTTONOUS.

- (1) Virtue
- (2) Vice
- (3) Avarice
- (4) Self-control

2) **DIRECTIONS** : Choose the pair of words which are related to each other same as the capitalized words given below:

MERCENARY:WAGES::DILETTANTE: _____?

- (1) Enjoyment
- (2) Rifle
- (3) Strife
- (4) Market

3) **DIRECTIONS** : Read the following sentences and find out the error in the underlined phrasal verb. Mark the correct phrasal verb from the given options:

Due to some minor issues, the committee called away the meeting.

- (1) Called off
- (2) Called in
- (3) Called upon
- (4) Called out

4) **DIRECTIONS** : Read the following sentences and find out the error in the underlined phrasal verb. Mark the correct phrasal verb from the given options:

Due to some minor issues, the committee called away the meeting.

When we hit the main city road, it was sarled on.

- (1) Sarled out
- (2) Sarled up
- (3) Sarled in
- (4) Sarled at

5) **DIRECTIONS**: Read the following passage carefully and mark the correct answer for the

questions given below:

Born out of the forces of globalisation, India's IT sector is undertaking some globalisation of its own. In search of new sources of rapid growth, the country's outsourcing giants are aggressively expanding beyond their usual stomping grounds into the developing world; setting up programming centres, chasing new clients and hiring local talent. Through geographic diversification, Indian companies hope to regain some momentum after the recession. This shift is being driven by a global economy in which the US is no longer the undisputed engine of growth. India's IT powers rose to prominence largely on the decisions made by American executives, who were quick to capitalize on the cost savings to be gained by outsourcing noncore operations, such as systems programming and call centres, to specialists overseas.

Revenues in India's IT sector surged from \$4 billion in 1998 to \$59 billion last fiscal, But with the recession NASSCOM forecasts that the growth rate of India's exports of IT and other business services to the US and Europe will drop to at most 7% in the current fiscal year, down from 16% last year and 29% in 2007-08.

Factors other than the crisis are driving India's IT firms into the emerging world. Although the US still accounts for 60% of the export revenue of India's IT sector, emerging markets are growing faster. Tapping these more dynamic economies won't be easy, however. The goal of Indian IT firms for the past 30 years has been to woo clients outside India and transfer as much of the actual work as possible back home, where lower wages for highly skilled programmers allowed them to offer significant cost savings. With costs in other emerging economies equally low, Indian firms can't compete on price alone.

To adapt, Indian companies which are relatively unknown in these emerging nations are establishing major local operations around the world, in the process hiring thousands of locals. Cultural conflicts arise at times while training new recruits. In addition, IT firms also have to work extra hard to woo business from emerging-market companies still unaccustomed to the concept of outsourcing. If successful, the future of India's outsourcing sector could prove as bright as it's past.

What is the author trying to convey through the phrase "India's IT sector is undertaking some globalization of its own"?

- (1) India has usurped America's position as the leader in IT.
- (2) The Indian IT sector is competing with other emerging nations for American business.
- (3) The Indian IT sector is considering outsourcing to developing economies.
- (4) Indian IT firms are engaging in expanding their presence internationally.

6) **DIRECTIONS:** Read the following passage carefully and mark the correct answer for the questions given below:

Born out of the forces of globalisation, India's IT sector is undertaking some globalisation of its own. In search of new sources of rapid growth, the country's outsourcing giants are aggressively expanding beyond their usual stomping grounds into the developing world; setting up programming centres, chasing new clients and hiring local talent. Through geographic diversification, Indian companies hope to regain some momentum after the recession. This shift is being driven by a global economy in which the US is no longer the undisputed engine of growth. India's IT powers rose to prominence largely on the decisions made by American executives, who were quick to capitalize on the cost savings to be gained by outsourcing noncore operations, such as systems programming and call centres, to specialists overseas.

Revenues in India's IT sector surged from \$4 billion in 1998 to \$59 billion last fiscal, But with the recession NASSCOM forecasts that the growth rate of India's exports of IT and other business services to the US and Europe will drop to at most 7% in the current fiscal year, down from 16% last year and 29% in 2007-08.

Factors other than the crisis are driving India's IT firms into the emerging world. Although the US still accounts for 60% of the export revenue of India's IT sector, emerging markets are growing faster. Tapping these more dynamic economies won't be easy, however. The goal of Indian IT firms for the past 30 years has been to woo clients outside India and transfer as much of the actual work as possible back home, where lower wages for highly skilled programmers allowed them to offer significant cost savings. With costs in other emerging economies equally low, Indian firms can't compete on price alone.

To adapt, Indian companies which are relatively unknown in these emerging nations are establishing major local operations around the world, in the process hiring thousands of locals. Cultural conflicts arise at times while training new recruits. In addition, IT firms also have to work extra hard to woo business from emerging-market companies still unaccustomed to the concept of outsourcing. If successful, the future of India's outsourcing sector could prove as bright as it's past.

What do the NASSCOM statistics about Indian IT exports indicate?

- (1) Drop in demand for IT services by Europe and the US
- (2) Indian IT firms charge exorbitantly for their services.
- (3) India has lost out to other emerging IT hubs
- (4) The Indian IT sector should undergo restructuring.

7) **DIRECTIONS:** Read the following passage carefully and mark the correct answer for the questions given below:

Born out of the forces of globalisation, India's IT sector is undertaking some globalisation of its own. In search of new sources of rapid growth, the country's outsourcing giants are aggressively expanding beyond their usual stomping grounds into the developing world; setting up programming centres, chasing new clients and hiring local talent. Through geographic diversification, Indian companies hope to regain some momentum after the recession. This shift is being driven by a global economy in which the US is no longer the undisputed engine of growth. India's IT powers rose to prominence largely on the decisions made by American executives, who were quick to capitalize on the cost savings to be gained by outsourcing noncore operations, such as systems programming and call centres, to specialists overseas.

Revenues in India's IT sector surged from \$4 billion in 1998 to \$59 billion last fiscal, But with the recession NASSCOM forecasts that the growth rate of India's exports of IT and other business services to the US and Europe will drop to at most 7% in the current fiscal year, down from 16% last year and 29% in 2007-08.

Factors other than the crisis are driving India's IT firms into the emerging world. Although the US still accounts for 60% of the export revenue of India's IT sector, emerging markets are growing faster. Tapping these more dynamic economies won't be easy, however. The goal of Indian IT firms for the past 30 years has been to woo clients outside India and transfer as much of the actual work as possible back home, where lower wages for highly skilled programmers allowed them to offer significant cost savings. With costs in other emerging economies equally low, Indian firms can't compete on price alone.

To adapt, Indian companies which are relatively unknown in these emerging nations are establishing major local operations around the world, in the process hiring thousands of locals. Cultural conflicts arise at times while training new recruits. In addition, IT firms also have to work extra hard to woo business from emerging-market companies still unaccustomed to the concept of outsourcing. If successful, the future of India's outsourcing sector could prove as bright as it's past.

According to the passage, which of the following is NOT a difficulty that Indian IT firms will face in emerging markets?

- (1) Mindset resistant to outsourcing
- (2) Local IT services are equally cost-effective
- (3) The US is their preferred outsourcing destination
- (4) Conflicts arising during the training of local talent

8) **DIRECTIONS:** Read the following passage carefully and mark the correct answer for the questions given below:

Born out of the forces of globalisation, India's IT sector is undertaking some globalisation of its own. In search of new sources of rapid growth, the country's outsourcing giants are aggressively expanding beyond their usual stomping grounds into the developing world; setting up programming centres, chasing new clients and hiring local talent. Through geographic diversification, Indian companies hope to regain some momentum after the recession. This shift is being driven by a global economy in which the US is no longer the undisputed engine of growth. India's IT powers rose to prominence largely on the decisions made by American executives, who were quick to capitalize on the cost savings to be gained by outsourcing noncore operations, such as systems programming and call centres, to specialists overseas.

Revenues in India's IT sector surged from \$4 billion in 1998 to \$59 billion last fiscal, But with the recession NASSCOM forecasts that the growth rate of India's exports of IT and other business services to the US and Europe will drop to at most 7% in the current fiscal year, down from 16% last year and 29% in 2007-08.

Factors other than the crisis are driving India's IT firms into the emerging world. Although the US still accounts for 60% of the export revenue of India's IT sector, emerging markets are growing faster. Tapping these more dynamic economies won't be easy, however. The goal of Indian IT firms for the past

30 years has been to woo clients outside India and transfer as much of the actual work as possible back home, where lower wages for highly skilled programmers allowed them to offer significant cost savings. With costs in other emerging economies equally low, Indian firms can't compete on price alone.

To adapt, Indian companies which are relatively unknown in these emerging nations are establishing major local operations around the world, in the process hiring thousands of locals. Cultural conflicts arise at times while training new recruits. In addition, IT firms also have to work extra hard to woo business from emerging-market companies still unaccustomed to the concept of outsourcing. If successful, the future of India's outsourcing sector could prove as bright as it's past.

Which of the following words is most opposite in meaning to the word 'UNDISPUTED' as used in the passage?

- (1) Challenging
- (2) Doubtful
- (3) Deprived
- (4) Comprehend

9) **DIRECTIONS :** The following questions have a set of four statements. You have to figure out the correct order in which these statements should be arranged for the paragraph to make sense.

- (A) A community cannot long survive on hatred alone.
- (B) The main basis of the creation of Pakistan was the hatred of the Hindus.
- (C) And on that poison, they have tried to live.
- (D) I have therefore been driven powerfully, to my central thesis that we shall come together again,

precisely because we hate each other too deeply to be parted: a reflex index of the deep fraternity that is embedded in the blood stream of both the communities.

- (1) ABCD
- (2) DCBA
- (3) BACD
- (4) CDAB

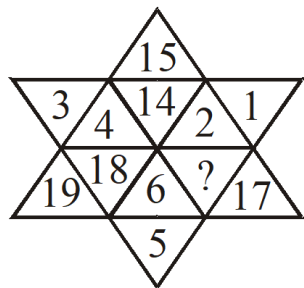
10) **DIRECTIONS :** The following questions have a set of four statements. You have to figure out the correct order in which these statements should be arranged for the paragraph to make sense.

- (A) Being able to go to school is in fact a sign of the most incredible freedom.
- (B) On the other hand, many children in more fortunate circumstances who do have the opportunity to attend school don't appreciate how free they really are.
- (C) Children who are suffering from serious illnesses or living in war-torn countries can't go to school even if they want to.
- (D) And it is a mistake not to realize it.

- (1) DCAB
- (2) ACBD
- (3) CBAD
- (4) DABC

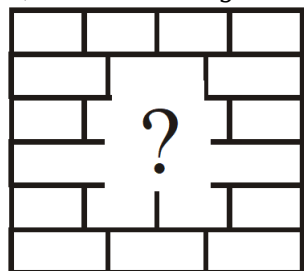
PART-IV(B) : Logical Reasoning

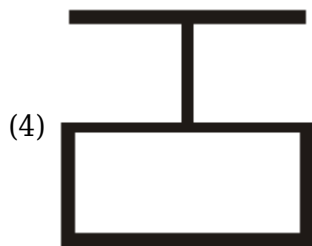
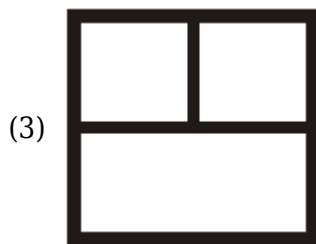
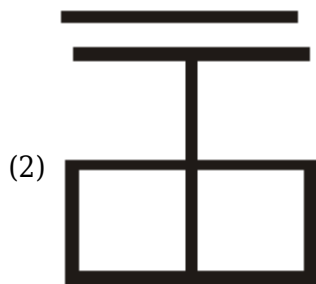
1) Select the correct option to replace the question mark in the given figure.



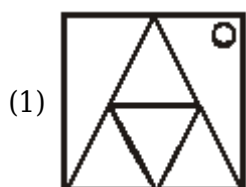
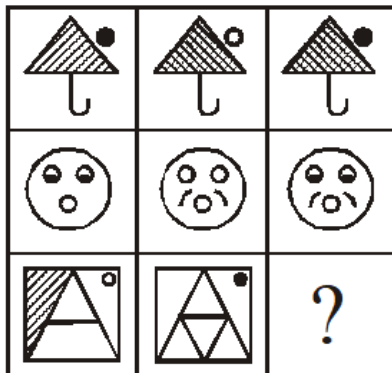
- (1) 22
- (2) 16
- (3) 10
- (4) 20

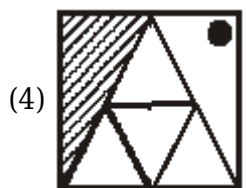
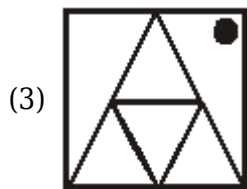
2) Choose the figure to complete the given pattern.



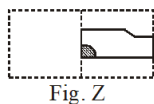
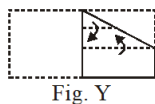
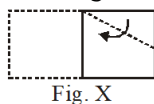
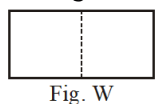


3) Identify the figure that completes the given figure matrix.





4) Identify the figure (out of Figures A, B C and D) that most closely resembles the unfolded for of the figure Z (after cutting out the shaded part out of it).



5) Choose the correct option to replace the question mark in the given series.

1, ?, 2, 22, 3, 32, 4, 42

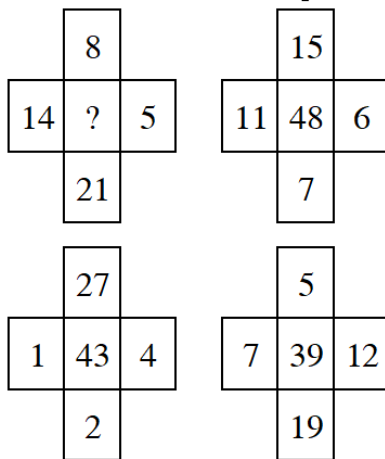
(1) 4

(2) 12

(3) 3

(4) 2

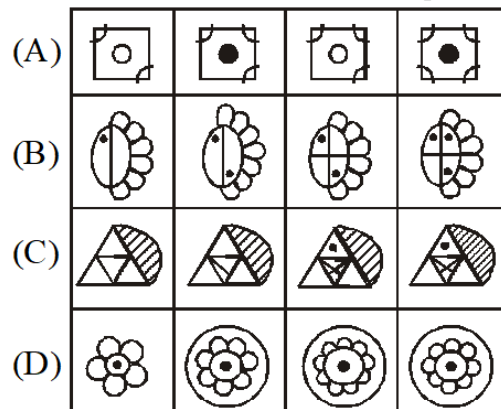
6) Select the correct option to replace the question mark in the given figure.



- (1) 33
- (2) 34
- (3) 35
- (4) 36

7) Identify the set of figures which follows the given rule.

Rule: The series becomes complex as it proceeds.



- (1) A
- (2) B
- (3) C
- (4) D

8) Trace out the figure (out of the four given options) which contains fig. X as its part.

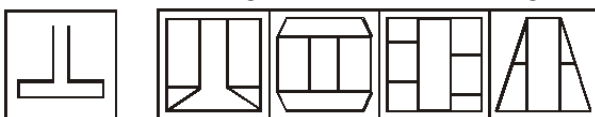


Fig. X (A) (B) (C) (D)

- (1) A
- (2) B
- (3) C
- (4) D

9) Choose the word which is different from the rest.

- (1) February
- (2) May
- (3) December
- (4) March

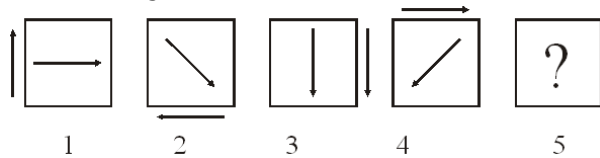
10) Select the correct group of letters from the given options to replace the question mark in the given analogy.

Pragmatic: Quixotic :: Murky : ?

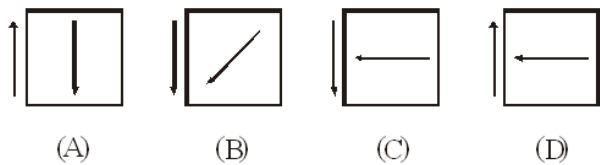
- (1) Clear
- (2) Rapid
- (3) Friendly
- (4) Cloudy

11) **Direction:-** Study the series of given figures and select the appropriate figure from answer figures that will complete the question figure series.

Problem figures:



Answer figure:



- (1) A
- (2) B
- (3) C
- (4) D

12) If DOCTOR is coded as 36, then how will PATIENT be coded as

- (1) 40
- (2) 49
- (3) 81
- (4) 50

13) A is the son of B. C is wife of A. E is daughter of C. How is E related to B?

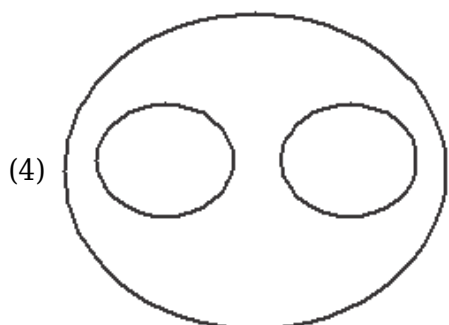
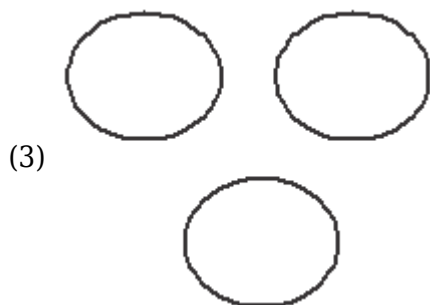
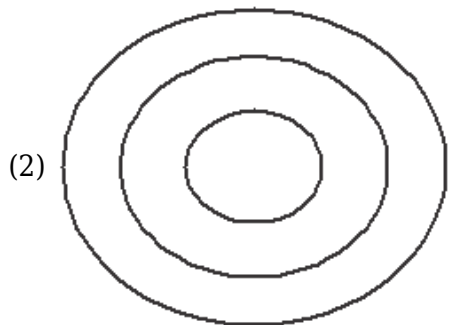
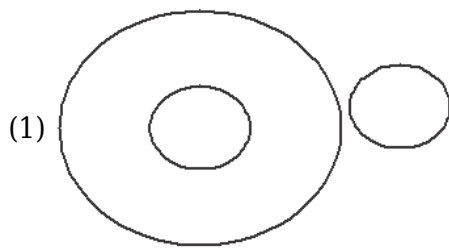
- (1) Grand Daughter
- (2) Grand Son
- (3) Son
- (4) Daughter

14) Five girls are sitting in a row. Pratima is to the right of Mona. Nidhi is to the left of Mona, but is to the right of Natasha. Pratima is to the left of Anu. The girl sitting on the extreme left is

- (1) Anu
- (2) Natasha
- (3) Pratima
- (4) Nidhi

15) **Direction:** Which of the following diagrams correctly represents the relation between given three words.

BED, WARD, HOSPITAL



16) If 'Tee see pee' means 'Drink fruit Juice' and 'see kee lee' means 'Juice is sweet' and 'lee ree mee' means 'He is intelligent' then what will be the meaning of 'sweet' in that code language?

- (1) See

- (2) Kee
- (3) Tee
- (4) Pee

17) A bus leaves for Delhi in every 30 minutes from a bus stand an enquiry clerk told a passenger that the bus had already left 10 minutes ago and the next bus will leave at 9.35 am. At what time did the enquiry clerk give information to the passenger?

- (1) 9.10 am
- (2) 9.15 am
- (3) 8.55 am
- (4) 8.08 am

18) A table clock is placed on the table in such a way that the hour hand will point towards north at 6:00O' clock. In which direction will the minute hand be at 9:15 O'clock

- (1) North
- (2) South
- (3) East
- (4) West

19) Arrange words as they occur in dictionary.

- (I) Pestle (II) Pestilence
- (III) Pester (IV) Pest
- (V) Pessimist

- (1) IV, III, I, V, II
- (2) III, IV, II, V, I
- (3) V, IV, III, II, I
- (4) IV, V, I, II, III

20) **Direction :** There are two words separated by ':' and other two separated from the first two by the symbol '::'. Find the relation between two sets of words and select one word from the right side of ':' which have the same relation as left set of words '::'. Fill the circle of the letter denoting your selected answer on the OMR Answer Sheet.

Sesimolgist : Earthquakes :: Geologist : ?

- (1) Universe
- (2) Earth
- (3) Sun
- (4) Plants

ANSWER KEYS

PART-I : PHYSICS

Q.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A.	2	4	1	1	1	4	2	2	4	1	3	4	1	2	1	2	1	4	3	2
Q.	21	22	23	24	25	26	27	28	29	30										
A.	3	1	3	3	1	1	1	4	1	4										

PART-II : CHEMISTRY

Q.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
A.	2	1	1	2	3	1	4	4	3	4	3	4	3	4	2	1	4	3	3	4
Q.	51	52	53	54	55	56	57	58	59	60										
A.	1	4	2	4	2	3	3	4	4	1										

PART-III : MATHEMATICS

Q.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
A.	3	3	1	3	4	4	4	3	3	1	4	1	4	1	3	2	3	4	2	3
Q.	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
A.	2	4	3	1	2	2	1	4	1	3	1	2	4	1	4	1	4	3	1	1

PART-IV(A) : English Proficiency

Q.	101	102	103	104	105	106	107	108	109	110
A.	3	1	1	2	4	1	3	2	1	3

PART-IV(B) : Logical Reasoning

Q.	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130
A.	2	4	4	1	2	2	C	A	1	1	D	2	1	2	2	2	2	4	3	2

SOLUTIONS

PART-I : PHYSICS

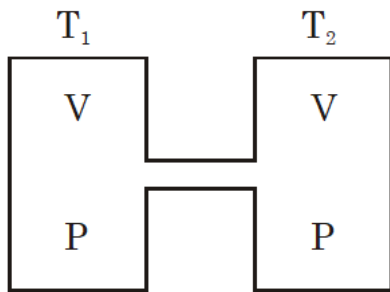
2) Coefficient of volume expansion

$$\gamma = \frac{\rho_1 - \rho_2}{\rho_1 \Delta T} = \frac{(10 - 9.7)}{10 \times (100 - 0)} = 3 \times 10^{-4}$$

Hence, coefficient of linear expansion

$$\alpha = \frac{\gamma}{3} = 10^{-4}/^{\circ}\text{C}$$

3) A cavity behaves somewhat like a black body, and has greater emissivity than the rest of the wood, at the same temperature.



7)

$$T_2 > T_1$$

$$PV = nRT = \text{constant}$$

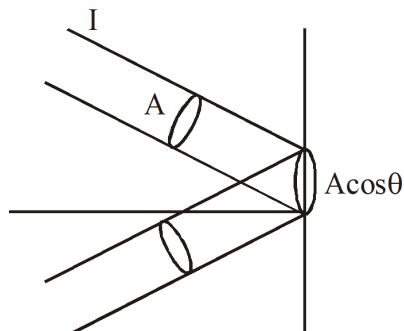
$$n_1 T_1 = n_2 T_2$$

$$n_1 < n_2$$

$$12) \quad d = \lambda_d = \frac{h}{p} = \frac{h}{mv}$$

$$d = \frac{h}{\left[\rho \cdot \frac{4}{3} \pi \left(\frac{d}{2} \right)^3 \right] \times (\sqrt{2gd})}$$

$$d = \left(\frac{18h^2}{\pi^2 \rho^2 g} \right)^{1/9}$$



$$13) \quad \left(\frac{dp}{dt} \right)_{\text{incident}} = \frac{I}{C} A \cos^2 \theta$$

$$\left(\frac{dp}{dt}\right)_{\text{reflected}} = \frac{-I}{C} A 0.5 \cos^2 \theta$$

$$F = \frac{3I}{2C} A \cos^2 \theta$$

$$\frac{F}{A} = P = \frac{3I}{2C} \cos^2 \theta = \frac{3I}{4C}$$

14) Maximum KE of photoelectron

$$\frac{1}{2}mv_{\text{max}}^2 = \frac{hc}{\lambda} - \phi$$

$$\Rightarrow v_{\text{max}} = \sqrt{\frac{2}{m} \left(\frac{hc}{\lambda} - \phi \right)}$$

$$= \sqrt{\frac{2}{9 \times 10^{-31}} \left(\frac{6.6 \times 10^{-34} \times 3 \times 10^8}{3300 \times 10^{-10}} - 2.5 \times 1.6 \times 10^{-19} \right)}$$

$$= \sqrt{\frac{4}{9} \times 10^{12}} = \frac{2}{3} \times 10^6 \text{ ms}^{-1}$$

$$= \frac{Mv_{\text{max}}^2}{R_{\text{max}}}$$

Now $\text{Bev}_{\text{max}} = \frac{Mv_{\text{max}}^2}{BR_{\text{max}}}$

$$\Rightarrow e = \frac{Mv_{\text{max}}}{BR_{\text{max}}} = \frac{9 \times 10^{-31} \times \frac{2}{3} \times 10^6}{6.7 \times 10^{-6} \times 0.5}$$

$$= 1.8 \times 10^{-19} \text{ C}$$

15) $\sqrt{f} = (Z-b) \left(1 - \frac{1}{n^2} \right)^{1/2}$

16) Mass of 1m^3 volume = 1000kg

from equation of continuity

$$A_Q = 3A_P$$

$$V_Q A_Q = A_P V_P$$

$$V_Q 3A_P = A_P (3)$$

$$V_Q = 1\text{m/s}$$

A change is in P.E = $1000 \times 10 \times \frac{1}{2} = 5000\text{J}$

change in K.E = $\frac{1}{2} \times 1000 (3^2 - 1^2) = 4000\text{J}$

Net work done by pressure = 1000J/m^3

$$B = \frac{\mu_0 N i R^2}{2(R^2 + x^2)^{3/2}}$$

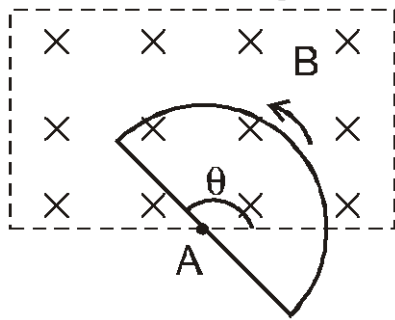
18) $B_{\text{max}} = x_{\text{min}} = 0$

19) $qE = qvB$

21) $X = \frac{C}{T}$

22) The flux through loop = $\phi = B \left(\frac{1}{2} r^2 \theta \right)$

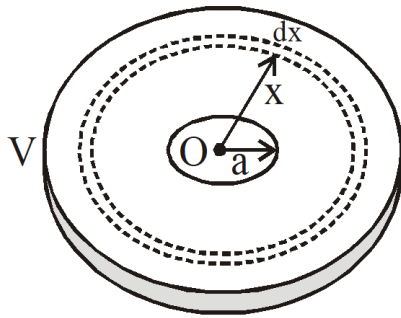
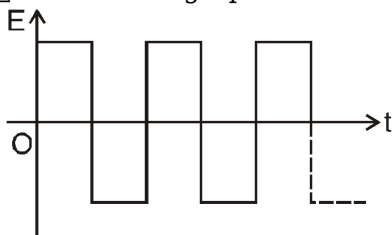
Induced emf in loop = $\frac{d\phi}{dt} = \frac{1}{2} B r^2 \omega$



$\omega = \text{constant}$, emf shall be constant in magnitude.

Since magnetic flux increases for half cycle and decreases for the other half. Hence emf changes sign every half cycle.

The correct graph is



26)

$$dR = \frac{\rho dr}{2\pi r t} \quad (\text{All in series})$$

$$\therefore R = \int_a^b \frac{\rho dr}{2\pi r t} = \frac{\rho}{2\pi t} \ln \left(\frac{b}{a} \right)$$

27) Current won't pass through 4Ω & 6Ω

$$\text{so } P = \frac{(30)^2}{3} = 300 \text{ W}$$

$$I = \frac{30}{3} = 10 \text{ A}$$

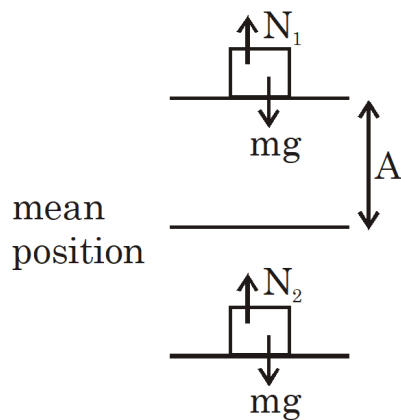
28) Internal loss = $i^2 r$

$$i = \frac{\mathcal{E}}{r + R}$$

$$\text{battery life time} = \frac{\text{Battery cap.}}{\text{Current}}$$

$$29) \frac{d^2x}{dt^2} = kx; \frac{d^2x}{dt^2} = -\omega^2 x$$

$$\omega^2 = k; \omega = \sqrt{k}; T = \frac{2\pi}{\omega} = \frac{2\pi}{\sqrt{k}}$$



30)

$$mg - N_1 = m\omega^2 A$$

$$N_2 - mg = m\omega^2 A$$

$$N_1 = mg - m\omega^2 A$$

$$N_2 = mg + m\omega^2 A$$

$$N_1 = 600 - 60 \times 16 \times \frac{1}{10}$$

$$= 536 \text{ N} \Rightarrow m = 53.6 \text{ kg}$$

$$N_2 = 600 + 64 = 664 \Rightarrow m = 66.4 \text{ kg}$$

PART-II : CHEMISTRY

46)

(A) cis-1, 4-polyisoprene

PART-III : MATHEMATICS

61) Let $2^x = y$, then 6th term is

$${}^8C_5 \left((y^2 + 5)^{1/3} \right)^{8-5} \left(\frac{1}{(y+1)^{1/5}} \right)^5 = 168$$

$$\Rightarrow \frac{8 \times 7 \times 6}{3!} \left(\frac{y^2 + 5}{y+1} \right) = 168 \Rightarrow \frac{y^2 + 5}{y+1} = 3$$

$$\Rightarrow y^2 - 3y + 2 = 0 \Rightarrow y = 1, 2$$

$$\Rightarrow 2^x = 1 = 2^0 \Rightarrow x = 0$$

$$2^x = 2 = 2^1 \Rightarrow x = 1$$

62) Let $\vec{a} = 2\hat{i} + x\hat{j} + z\hat{k}$

$$\sqrt{5x^2 + z^2} = 5\sqrt{2}$$

Also, $\cos 135 = \frac{z}{\sqrt{5x^2 + z^2}} = \frac{z}{5\sqrt{2}} = -\frac{1}{\sqrt{2}}$
 $\Rightarrow z = -5$, then $x = \sqrt{5}$,
 The required vector $\vec{a} = 2\sqrt{5}\hat{i} + \sqrt{5}\hat{j} - 5\hat{k}$

63) Common chord = diameter of second circle

$$= 2\sqrt{(-1)^2 + (-2)^2 - (-11)} = 8$$

then area = $\frac{\sqrt{3}}{4}(8)^2 = 16\sqrt{3}$ sq.units

64) Cubing the equation $\sin x + \operatorname{cosec} x = 2$

$$\Rightarrow \sin^3 x + \operatorname{cosec}^3 x + 3\sin x \operatorname{cosec} x (\sin x + \operatorname{cosec} x) = 8$$

$$\Rightarrow \sin^3 x + \operatorname{cosec}^3 x + 3(2) = 8$$

$$\Rightarrow \sin^3 x + \operatorname{cosec}^3 x = 2$$

65) Let $f'(x) = 3ax^2 - 4bx + c$

$$\Rightarrow f(x) = ax^3 - 2bx^2 + cx + d$$

Now $f(0) = f(1)$ & $f(x)$ is continuous in $[0, 1]$ and differentiable in $(0, 1)$.

So, by Rolle's theorem, $3ax^2 - 4bx + c = 0$ has atleast one root between 0 and 1.

66) We have, $a_1 + a_5 + a_{10} + a_{15} + a_{20} + a_{24} = 225$

$$\Rightarrow (a_1 + a_{24}) + (a_5 + a_{20}) + (a_{10} + a_{15}) = 225$$

$$\Rightarrow 3(a_1 + a_{24}) = 225$$

($\because$ in an A.P. n^{th} term from beginning + n^{th} term from end = first term + last term)

$$\Rightarrow a_1 + a_{24} = 75 \quad \dots(1)$$

$$\therefore a_1 + a_2 + a_3 + \dots + a_{23} + a_{24}$$

$$\Rightarrow (a_1 + a_{24}) + (a_2 + a_{23}) + (a_3 + a_{22}) + \dots + (a_{12} + a_{13})$$

$$\Rightarrow 12(a_1 + a_{24}) = 12 \cdot 75 \quad \text{from (1)}$$

$$= 900$$

67) Length of tangent = length of subnormal

$$\Rightarrow \frac{dy}{dx} = \pm 1$$

$$\frac{dy}{dx} = 1$$

If $\frac{dy}{dx} = 1$, then equation of tangent at (3, 4) is $y - 4 = x - 3$ or $y = x + 1$ which cuts coordinate axes at (0, 1) & (-1, 0)

$$\frac{dy}{dx} = -1,$$

If $\frac{dy}{dx} = -1$, then equation of tangent at (3, 4) is $y - 4 = -(x - 3)$ or $x + y = 7$ which cuts positive coordinate axes at A(7, 0) and B(0, 7)

$$\therefore \text{Area of } \triangle OAB = \frac{1}{2} \cdot 7 \cdot 7 = \frac{49}{2}$$

68) If one root is $2i$ then other root is $-2i$

$$\therefore \text{sum of the roots} = 0$$

$$\Rightarrow -B/A = 0 \Rightarrow B = 0$$

$$\therefore B^3(A^3 - C^3) = 0.$$

69) Length of normal

$$= y \sqrt{1 + \left(\frac{dy}{dx}\right)^2} = a(1 - \cos t) \sqrt{1 + \tan^2 \frac{t}{2}}$$

$$= a \left(2 \sin^2 \frac{t}{2}\right) \left(\sec \frac{t}{2}\right) = 2a \sin^2 \frac{t}{2} \sec \frac{t}{2}$$

70) Since $f(x+1) - f(x)$

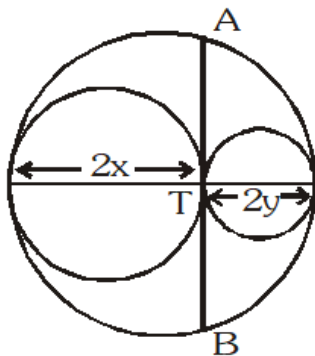
$$= (x+1+c) - (x+c) = 1$$

$f(1), f(2), f(3), \dots, f(n)$ is A.P. with common difference equal to 1.

$$\sum_{x=1}^n f(x) = \sum_{x=1}^n (x+c) = \sum_{x=1}^n x + c \sum_{x=1}^n 1 \quad \dots(1)$$

$$= \frac{n(n+1)}{2} + nc = \frac{n(n+2c+1)}{2}$$

71) Let T is point of contact



power of point

$$= TA \cdot TB = 2x \cdot 2y$$

$$\Rightarrow xy = 1$$

$$\text{We have to find } \pi [(x+y)^2 - x^2 - y^2] = \pi[2xy] = 2\pi$$

$$(\alpha, \beta), (\beta, \gamma) \text{ \& } (\gamma, \alpha)$$

72) If $x^2 + ax + b = 0$; $x^2 + bx + c = 0$; $x^2 + cx + a = 0$ have the

roots respectively then

$$\alpha\beta = b, \beta\gamma = c, \gamma\alpha = a$$

$$\alpha^2\beta^2\gamma^2 = abc \Rightarrow \alpha\beta\gamma = \pm \sqrt{abc}$$

73) $(a,3)$ lies inside $x^2 + y^2 - 16 = 0$ and outside $x^2 + y^2 - 4 = 0$ and above $y = x$ in first quadrant so

$$a^2 + 9 - 16 < 0 \Rightarrow -\sqrt{7} < a < \sqrt{7} \quad \dots(i)$$

$$a^2 + 9 - 4 > 0 \Rightarrow a \in \mathbb{R} \quad \dots(ii)$$

$$a - 3 < 0 \Rightarrow a < 3 \quad \dots(iii)$$

$$\text{in first quadrant } a > 0 \quad \dots(iv)$$

$$\text{from (i), (ii), (iii) \& (iv)} \Rightarrow a \in (0, \sqrt{7})$$

p

74) Let $\frac{p}{q}$ be one of the roots (where p & q are relatively prime numbers)

$$\Rightarrow \frac{p^3}{q^3} - \frac{3p}{q} + 1 = 0$$

$$\Rightarrow p^3 - 3pq^2 + q^3 = 0$$

$$\Rightarrow q^3 = p(3q^2 - p^2)$$

$$\Rightarrow \frac{q^3}{p} = 3q^2 - p^2$$

Since p & q are relatively prime numbers

$\therefore$ RHS is always an integer

$$\therefore p = 1$$

$$\Rightarrow q^3 = q^2 - 1$$

$$\Rightarrow q^2(q - 3) = -1$$

$$q^2 = 1 \text{ \& } q - 3 = 1$$

$$\text{or } q^2 = -1 \text{ \& } q - 3 = 1$$

$$q = \pm 1 \quad q = 4$$

Not possible

$\therefore$ No value of q

Hence given equation does not have any rational root.

$$75) \quad z + \frac{1}{z} = w + \frac{1}{w}$$

$$\Rightarrow z - w = \frac{z - w}{zw}$$

$$\Rightarrow z = w \text{ or } zw = 1 \quad \dots(i)$$

Similarly

$$z + \frac{1}{w} = w + \frac{1}{z} \Rightarrow z - w = \frac{(z - w)}{-zw}$$

$$\Rightarrow z = w \text{ or } zw = -1 \quad \dots(ii)$$

From (i) and (ii)

$$z = w$$

$$\Rightarrow |z^2 - w^2| = 0$$

76) 5 cards are required for 2 clubs means in first 4 draws there is only one club and fifth drawn card is a club.

$\Rightarrow$ one card is drawn from 13 clubs, The other 3 cards are drawn from non club cards and none of them is ace of heart.

$\therefore$ The required probability

$$= \underbrace{\frac{{}^{13}C_1 \times {}^{38}C_3}{{}^{52}C_4}}_{\text{Probability of drawing first 4 cards}} \times \underbrace{\frac{{}^{12}C_1}{{}^{48}C_1}}_{\text{Probability of drawing 5th card, which is a club}} \times \underbrace{\frac{1}{{}^{47}C_1}}_{\text{Probability of drawing 6th card, which is Ace of heart}} = \frac{13}{188} \cdot \frac{{}^{38}C_3}{{}^{52}C_4}$$

$$78) \quad \frac{\text{dearrangement of 5 objects}}{5!} = \frac{44}{120} = \frac{11}{30}$$

$$79) f(x) = \begin{cases} \frac{x \ell_n \cos x}{\ell_n (1+x^2)}, & x \neq 0 \\ 0, & x = 0 \end{cases}$$

One should check the derivability at $x = 0$ only

$$f'(0) = \lim_{h \rightarrow 0} \frac{h \ell_n \cosh}{h \ell_n (1+h^2)} = \frac{-\tanh}{2h} = -\frac{1}{2}$$

$\Rightarrow$ function is derivable at $x = 0 \Rightarrow A$

$$82) \frac{1}{2} \begin{vmatrix} \lambda+1 & 2\lambda+1 & 2\lambda+2 & \lambda+1 \\ 1 & 3 & 2\lambda & 1 \end{vmatrix} = 0$$

$$\Rightarrow \frac{1}{2} |3\lambda+3-2\lambda-1+4\lambda^2+2\lambda-6\lambda+6+2\lambda+2-2\lambda^2-2\lambda| = 0$$

$$\frac{1}{2} (2\lambda^2-3\lambda-2) = 0$$

$$2\lambda^2-4\lambda+\lambda-2=0$$

$$(2\lambda+1)(\lambda-2)=0$$

$$\lambda = -\frac{1}{2}, 2$$

$$83) \text{ Let } x = \frac{ab}{t} \Rightarrow dx = -\frac{ab}{t^2} dt$$

$$\Rightarrow I_2 = \int_a^b \frac{e^{t/a}}{\frac{ab}{t}} \cdot \frac{ab}{t^2} dt$$

$$\Rightarrow I_2 = I_1$$

$$85) \int_1^2 e^{x^2} dx = \alpha \quad I = \int_e^{e^4} \sqrt{\ell n x} dx$$

$$x = e^t \Rightarrow dx = e^t dt$$

$$x = \int_1^4 \sqrt{t} e^t dt \quad \text{put } t = y^2$$

$$\Rightarrow x = \underbrace{2 \int_1^2 y^2 e^{y^2} dy}_I = 4\alpha$$

86) Remaining 10 persons can be distribute to 2 graphs of 6 & 4 in $\frac{10!}{4!6!}$ ways now there person can sit in $\frac{8!10!}{4!6!}$ ways

$$87) \sum_{r=0}^m = \begin{vmatrix} \Sigma (2r-1) & \Sigma m c_r & \Sigma 1 \\ m^2 - 1 & 2^m & m + 1 \\ \sin^2(m) & \sin^2(m) & \sin^2(m+1) \\ m(m+1) - (m+1) & 2^m & m+1 \end{vmatrix}$$

$$= \begin{vmatrix} m^2 - 1 & 2^m & m + 1 \\ \sin^2(m) & \sin^2(m) & \sin^2(m+1) \end{vmatrix} = 0$$

$$89) \begin{vmatrix} -1 & 2 & 1 \\ 3 + 2\sqrt{2} & 2 + 2\sqrt{2} & 1 \\ 3 - 2\sqrt{2} & 2 - 2\sqrt{2} & 1 \end{vmatrix} R_3 \rightarrow R_2 + R_3$$

$$= 2 \begin{vmatrix} -1 & 2 & 1 \\ 3 + 2\sqrt{2} & 2 + 2\sqrt{2} & 1 \\ 3 & 2 & 1 \end{vmatrix} R_1 \rightarrow R_1 - R_3$$

$$= 2 \begin{vmatrix} -4 & 0 & 0 \\ 3 + 2\sqrt{2} & 2 + 2\sqrt{2} & 1 \\ 3 & 2 & 1 \end{vmatrix}$$

$$= 2 \begin{bmatrix} -4(2 + 2\sqrt{2} - 2) \end{bmatrix} = -16\sqrt{2}$$

absolute value = $16\sqrt{2}$

So, (A) is correct.

$$91) f(x) = \lim_{n \rightarrow \infty} (1+x)(1+x^2)(1+x^{2^2})(1+x^{2^3}) \dots (1+x^{2^n})$$

$$= \frac{(1-x)(1+x)(1+x^2)(1+x^{2^2}) \dots (1+x^{2^n})}{(1-x)}$$

$$= \lim_{n \rightarrow \infty} \frac{(1-x^2)(1+x^2)(1+x^{2^2}) \dots (1+x^{2^n})}{(1-x)}$$

$$= \lim_{n \rightarrow \infty} \frac{(1-x^{2^2})(1+x^{2^2}) \dots (1+x^{2^n})}{(1-x)}$$

Continuing in the similar manner we get,

$$f(x) = \lim_{n \rightarrow \infty} \frac{(1-x^{2^n})(1+x^{2^n})}{(1-x)} = \lim_{n \rightarrow \infty} \frac{1-x^{2^{n+1}}}{1-x}$$

$$= \frac{1}{1-x}$$

$$\{\square |x| < 1 \Rightarrow x^{2^{n+1}} \rightarrow 0\}.$$

92)

Ans is (B)

93) Let $I = \int_0^{\infty} \frac{e^{-1/x^5}}{x^3 \sqrt{x}} dx = \int_0^{\infty} \frac{e^{-1/x^5}}{x^{7/2}} dx$

Put $\frac{1}{x^5} = t^2$ or $\frac{1}{x^{5/2}} = t$

$-\frac{5}{2} x^{-7/2} dx = dt$

$\frac{1}{x^{7/2}} dx = -\frac{2}{5} dt$

$\Rightarrow I = -\frac{2}{5} \int_{\infty}^0 e^{-t^2} dt = \frac{2}{5} \int_0^{\infty} e^{-t^2} dt = \frac{2\alpha}{5}$

94) Let $\tan^{-1}x = A$, $\tan^{-1}y = B$, $\tan^{-1}z = C$, then $A + B + C = \pi$

$\Rightarrow \tan(A + B) = \tan(\pi - C)$

$\frac{\tan A + \tan B}{1 - \tan A \tan B} = -\tan C$

$\Rightarrow \tan A + \tan B + \tan C = \tan A \tan B \tan C$

$\Rightarrow x + y + z = xyz$

96) $|\cot^{-1}x| = \cot^{-1}x$ (it is always +ve)

$|\tan^{-1}x| + \cot^{-1}x = \frac{\pi}{2}$

$|\tan^{-1}x| = \frac{\pi}{2} - \cot^{-1}x$

$|\tan^{-1}x| = \tan^{-1}x$

possible when $\tan^{-1}x$ is positive

$x \geq 0$

97) $(f + g)(x) = \begin{cases} 2x - 1 & x \in I \\ 2x - 1 & x \notin I \end{cases}$

$\Rightarrow (f + g)(x) = 2x - 1 \quad \forall x \in \mathbb{R}$

which is one-one onto

$\Rightarrow (f + g)^{-1}(x) = \frac{x + 1}{2}$

$\Rightarrow (f + g)^{-1}(0) = \frac{1}{2}$

98) $\int x \ln x dx + \frac{1}{2} \int x dx = \ln x \cdot \frac{x^2}{2} - \int \frac{1}{x} \frac{x^2}{2} dx + \frac{x^2}{4}$

$= \frac{x^2}{2} \ln x - \frac{x^2}{4} + \frac{x^2}{4} + c = \frac{x^2}{2} \ln x + c$

99) $\int x \sin \frac{1}{x} dx = \sin \frac{1}{x} \cdot \frac{x^2}{2} - \int \frac{x^2}{2} \cos \frac{1}{x} \times -\frac{1}{x^2} dx + c$

$= \frac{x^2}{2} \sin \frac{1}{x} + \frac{1}{2} \int \cos \frac{1}{x} dx + c$

$$\begin{aligned}
&= \frac{x^2}{2} \sin \frac{1}{x} + \frac{1}{2} \left[x \cos \frac{1}{x} - \int x \cdot \left(-\sin \frac{1}{x} \right) \times -\frac{1}{x^2} dx \right] + c \\
&= \frac{x^2}{2} \sin \frac{1}{x} + \frac{1}{2} x \cos \frac{1}{x} - \frac{1}{2} \int \frac{1}{x} \sin \frac{1}{x} dx + c \\
&\Rightarrow \int \left(x + \frac{1}{2x} \right) \sin \frac{1}{x} dx = \frac{x^2}{2} \sin \frac{1}{x} + \frac{1}{2} x \cos \frac{1}{x} + c \\
&\Rightarrow \int \left(2x + \frac{1}{x} \right) \sin \frac{1}{x} dx = x^2 \sin \frac{1}{x} + x \cos \frac{1}{x} + c
\end{aligned}$$

100) The coefficient is
6!

$$\begin{aligned}
&\frac{1!2!3!}{6!} \cdot \operatorname{cosec} \theta \cdot \cos^2 \theta \cdot \sin^3 \theta = 15 \sin^2 2\theta \\
&\Rightarrow \text{maximum value is 15 at } \sin 2\theta = 1
\end{aligned}$$

PART-IV(A) : English Proficiency

101) **Explanation:** Thrifty means canny/careful with money; whereas, Avarice means extreme greed for wealth or material gain. In the same way gluttony is the vice of eating to excess while hunger is a need or compelling desire for food.

102) **Explanation:** Mercenary is a noun that means a professional soldier hired to serve in a foreign army who is hired and gets wages. Whereas, a dilettante is a person with an amateur interest in the arts who does it for enjoyment.

103) **Explanation:** The phrasal verb called away means to ask someone to leave a place, and called off on the other hand means to cancel or abandon. So according to the question the correct answer will be Option A.

104) **Explanation:** The word snarl means to say something in an angry, bad-tempered voice. In the sentence it is used as a phrasal verb; snarled on does not mean anything, so snarled up will be the correct answer that means a disorganized situation such as a traffic jam.

105) **Explanation:** According to the given passage the correct answer to the question will be option D only.

106) **Explanation:** According to the given passage the correct answer to the question will be option A only.

107) **Explanation:** According to the given passage the correct answer to the question will be option C only.

108) **Explanation:** According to the given passage the correct answer to the question will be option B only.

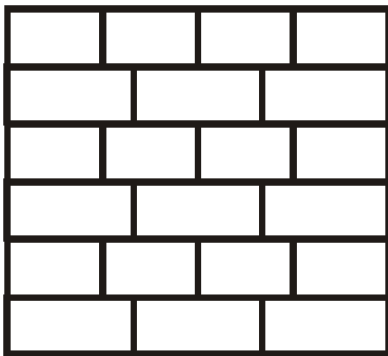
109) **Explanation:** Arrangement in option A gives meaning to the passage.

110) **Explanation:** Arrangement in option C gives meaning to the passage.

PART-IV(B) : Logical Reasoning

111) **Explanation:** The given figure contains numbers 1 to 6 in three alternate segments, the smaller number towards the outside and the numbers 14 to 19 in the remaining three alternate segments with smaller numbers towards the inside. Therefore option B is correct.

112) **Explanation:**



113) **Explanation:** The third figure in each row is the combination of the first two. Therefore option D is correct.

115) **Explanation:** The logic of the given series is as follows:

1, 13-1, 2, 23-1, 3, 33-1, 4, 43-1

Therefore option B is correct.

116) **Explanation:** Add up the four outer numbers and place your answer in the centre square of the shape one place clockwise. Therefore option B is correct.

119) **Explanation:** Except February, all other months have 31 days. Therefore option A is correct.

120) **Explanation:** Pragmatic is an antonym for quixotic, and clear is an antonym for murky. Therefore option A is correct.

121) Outer arrow is rotated by 90° anticlockwise and inner arrow is rotated by 45° clockwise direction.

122) (No. of letter in doctor)² = 36

Patient = 7 $\Rightarrow 7^2 = 49$

124) Natasha Nidhi Mona Pratima Anu

127) 9 : 05 $\xrightarrow{+10}$ 9 : 15 $\xrightarrow{+20}$ 9 : 35

128)

130) Seismology is the study of seismic waves, energy waves caused by rock suddenly breaking apart within the earth. So these events are called earthquakes. Similarly A Geologist is a scientist who studies the solid liquid and gaseous matter that constitutes the Earth.